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NEW HAMPSHIRE
AGRICULTURAL EXPERIMENT STATION

DEPARTMENT OF ENTOMOLOGY

Caterpillars Injuring Apple Foliage in Late Summer

Yellow-necked Apple Caterpillars.

By E. DWIGHT SANDERSON

NEW HAMPSHIRE COLLEGE
OF
AGRICULTURE AND THE MECHANIC ARTS
DURHAM, N. H.

NEW HAMPSHIRE COLLEGE

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BULLETIN 139.

CATERPILLARS INJURING APPLE FOLIAGE IN LATE SUMMER.

THE FALL WEB-WORM.*

The common Fall Web-worm is so named because of the web which it spins over its food plant in August and September, somewhat resembling that made by the Tent Caterpillar in the spring, with which it is often confused. (Concerning the Tent Caterpillar see Bulletin 38 of this Station.)

LIFE HISTORY AND DESCRIPTION.

The moths emerge from overwintering pupæ late in June and during July, frequently occurring at electric lights. The moths are of a pure white color, the wings expanding an inch to an inch and a quarter. This species is practically the only common moth which might be mistaken for the Brown-tail Moth, which is also pure white except the bushy brown tail, while the body of the fall web-worm moth is white. Rarely, however, the fall web-worm moths have the wings spotted more or less with black.

Eggs.—The eggs are laid by the female during July and are deposited upon the leaves of the food plants in clusters of 400 or 500. They are globular, about 1-50th of an inch in diameter, and of a pale yellowish-green color, often covered with whitish down from the body of the female. They usually hatch in about ten days.

Larva.—The young caterpillars, which seem to be almost all head and hair, at once commence to spin their web over the foliage upon which they are feeding. Within this web the colony from an egg mass feeds, enlarging it as it becomes necessary. The webs are usually started at the tips of limbs and are to be first noticed about August 1st. Within them the upper

* *Hyphantria textor* Harris.

and under surfaces of the leaves are eaten until they become dry and brown. (See figure 1.) The new webs of the fall web-worm might readily be mistaken for the work of the young brown-tail moth caterpillars, which also spin more or less of a web over the foliage upon which they feed; but the web-worm caterpillars appear earlier than those of the brown-tail and by the time the latter appear their webs cover a large part of a limb and the caterpillars are an inch or more long, while the young brown-tail caterpillars feed only on the leaves at the tips of the limbs, never form large webs, and never become over one-fourth of an inch long before they enter their winter webs for hibernation early in September. When the foliage within one web is entirely consumed the caterpillars will leave it and form a new

Fig. 1. Apple leaf denuded by young Webworms.

web upon a fresh branch and thus a tree soon becomes covered with these unsightly webs. These webs (fig. 2) are easily distinguishable from those of the Tent Caterpillar, which occur in the spring and never in late summer, as the Tent Caterpillar makes a tent-like web at the fork of a limb and never encloses foliage within it. When the food in the webs becomes scarce the older caterpillars scatter over the tree where food is more abundant, and as soon as full grown seek a place in which to spin their cocoons. The full grown caterpillars are about an inch long and quite "woolly," being thickly covered with long white and black hairs, which project from numerous prominent black tubercles. The younger caterpillars are pale yellowish with brown

Fig. 2. Web of Fall Webworms on Apple.

markings, but the larger ones become quite varied in color, some being uniformly yellowish with black and yellow tubercles, while others have a dark stripe running down the back and appear almost black. (Figure 3, a, b).

Cocoon and Pupa.—The mature caterpillar finds a secluded corner under the bark of the tree, or the rubbish at its base, in a

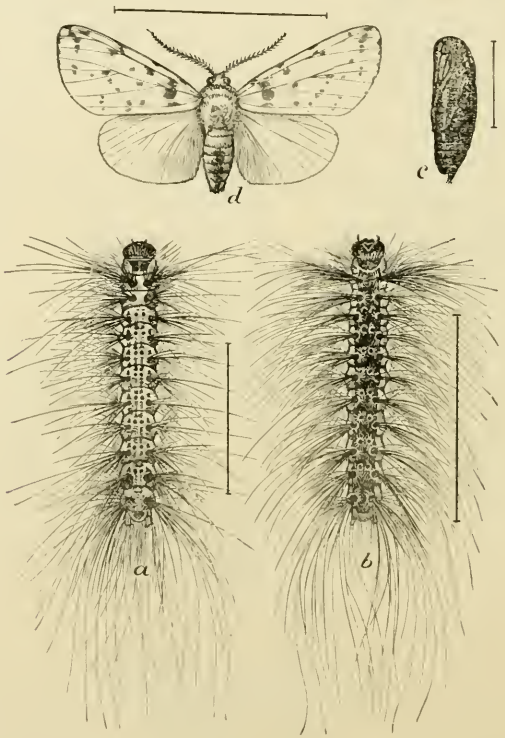

Fig. 3. Fall Webworm (*Hyphantria cunea* Den.) *a*. light form of full-grown larva; *b*. dark form of same; *c*. pupa; *d*. spotted form of moth—all slightly enlarged. (After Howard, U. S. Dept. Agr.)

fence corner, under the eaves or in the cracks of a building, or sometimes just under the surface of loose soil, and there spins its cocoon. Very frequently the old cocoon of some other moth is utilized or practically no cocoon is made. The cocoon is a flimsy affair at best, merely a thin covering of silk with which the caterpillar mingles some of its hairs as it spins the cocoon. Within it the caterpillar sheds its skin for the last time, having

already molted four or five times during growth, and the cast skin is tucked away at one end of the cocoon. With this molt the caterpillar has transformed to the pupa, similar to the chrysalis of butterflies. In 1905 the caterpillars pupated about September 7. In the pupa stage the insect remains dormant throughout the winter, the moths emerging from the pupæ in

Fig. 4. The Fall Webworm. Moth and cocoons, natural size.

June, as already described, June 9 and 10 being the exact dates at Durham in 1906.

Further south there are two broods in a season, but in New Hampshire but one seems to occur.

REMEDIES.

Spraying.—When the caterpillars are first noticed at work on the tips of the twigs, if they seem to be abundant, it is best to spray the tree with an arsenical. Arsenate of lead, five pounds to the barrel of water, is best, though Paris green, at the rate of

one pound to 100 gallons, with a pound or two of freshly slacked stone lime is equally effective, but does not adhere as well. It is useless to wait until the tree is covered with large webs and then spray. To be effective the tree must be sprayed early in August soon after the eggs hatch. As it is also advisable to spray at this time for the young brown-tail moth caterpillars, it will be found to be good practice to spray about this time every year.

Destroying the Pupae.—Much can be done to check the increase of the web-worms, as well as of other insects, by destroying the pupæ in the winter. They may commonly be found in hollow trees, under bark, in fence corners, under rubbish, etc. In many of these places they can be easily destroyed. We have found the hollow trunk of an old tree containing a score or more, when it might readily be cleaned out and filled with clay with benefit to the tree itself.

THE YELLOW-NECKED APPLE CATERPILLAR.*

During August one often notices the tips of the apple limbs defoliated for a foot or two. If examined for the cause of the damage either the Yellow-necked Apple Caterpillars or the next species to be described, the Red-humped Apple Caterpillars (See figure 5) are found huddled together as if confessedly guilty.

The Larva.—While young the caterpillars eat only the under

Fig. 5. The Yellow-necked Apple Caterpillar. A characteristic cluster of caterpillars. From life.

surfaces of the leaves and the softer parts, leaving the veins and upper surfaces, but as they become larger the whole leaf is devoured except the stem. The larvæ become full grown during the latter half of August, five or six weeks after hatching from the eggs. The caterpillar is then about two inches long with jet black head, and the next segment, often termed the neck, a bright orange yellow, from which the insect is named. Down the mid-

* *Datana ministra* Drury.

Fig. 6. The Yellow-necked Apple Caterpillar. *a*, larva slightly enlarged; *b*, pupa — greatly enlarged; *c*, moth, enlarged.

dle of the back runs a black stripe, and on either side of the body are three stripes of black alternating with four of yellow, the body being thinly clothed with long, soft, white hairs. The caterpillars feed together in colonies and are often found clustered together on a limb in a solid mass. If the limb bearing it is jarred or if a caterpillar is touched, it at once assumes a position characteristic of this genus, throwing the head and tail in the air with a jerk and clinging to the limb by the abdominal prolegs as shown in figure 6, a. A caterpillar will remain in this apparently lifeless position for several minutes, being the most accommodating insect to pose for a photograph we have met.

Pupa.—The full grown caterpillars descend from the tree at night and burrow into the earth for from two to four inches and there transform to the naked brown pupæ without forming any cocoons. The pupa does not differ noticeably from that of many moths and is shown in figure 6. Caterpillars which evidently hatched about August 1, 1906, entered the earth for pupation on September 6.

Moth.—The winter is passed in the pupal stage, the moths emerging from the middle of June through July, moths in our collection being dated June 20, 24, July 16, 1898. The wings expand about two inches and are a reddish-brown color, while the head and thorax are chestnut brown. The fore-wings have three to five transverse lines, one or two spots, and the extreme outer margin of a darker color. The hind wings are pale yellowish without markings.

Eggs.—Seventy-five to one hundred eggs are laid in a cluster on the surface of a leaf by each female, the round white eggs being placed side by side and cemented together in one mass much as shown in figure 7. The first eggs laid hatch during the latter part of July and others hatch during the first half of August, so that colonies of all ages are found at the same time in late August.

This species has been exceedingly abundant during the past two seasons and is one of the most common apple caterpillars of New England.

REMEDIES.

The same as for the Red-humped Apple Caterpillar, for which see page 218.

THE RED-HUMPED APPLE CATERPILLAR.*

With much the same habits and manner of injury as the last species and often associated with it; is the Red-humped Apple Caterpillar.

Larva.—The name is given on account of the prominent hump on the fourth segment, which, with the head, is a bright coral red. The body of the full grown caterpillar is striped with yellowish-white, and dark brown or black lines and a double row of black spines extends along the back. The back is marked with five narrow black lines. The first three segments are spotted with black and white; the sides of the fifth to tenth segments are whitish with black lines above the spiracles and with five black points, three above and two below the spiracles; the last segment is spotted with black. The legs are black and the prolegs black and yellow. The full grown caterpillar is about an inch and a quarter long and tapers toward the posterior end which is usually held in the air, as in figure 7, c.

The caterpillars appear about the same time in August and defoliate the limb from the tip inward the same as the Yellow-necked Apple Caterpillar. When full grown, from the 1st to the 20th of September, the caterpillars descend to the ground and under rubbish or among loose particles of earth construct a loose silken cocoon into which is glued particles of earth and rubbish so that it closely resembles its surroundings. After some time the caterpillars transform to pupæ, in which stage the winter is passed. Caterpillars constructed cocoons September 20, 1906, but had not transformed October 11.

These caterpillars are also gregarious and are often found huddled together in masses on the limbs. When handled a caterpillar will emit a fluid which has a peculiar acid smell and which doubtless serves as a defense against its enemies.

The caterpillars also feed on plum, rose, thorn, pear, cherry, willow, blackberry, and other related plants.

Moth.—The moths appear about the last of June. "The forewings of the moth are dark brown on the inner and grayish on the outer margin; they have a dark brown dot near the middle, a spot near each angle, and several longitudinal streaks of the

* *Schizura concinna* S. and A.

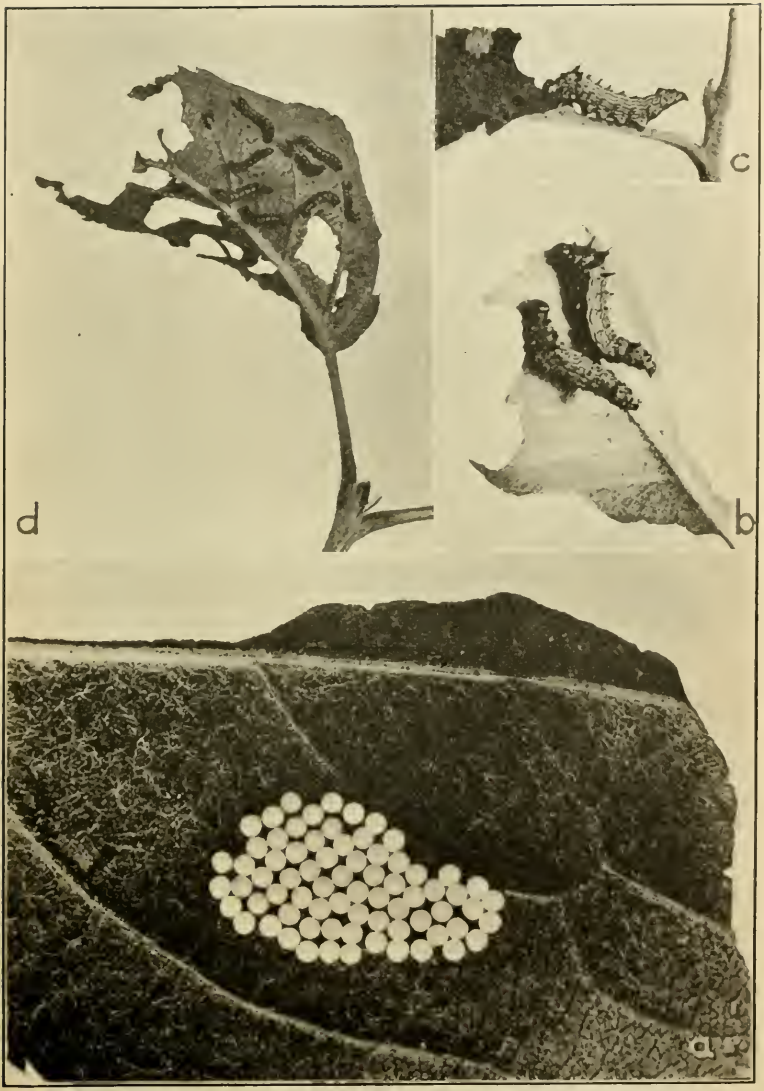

Fig. 7. The Red-humped Apple Caterpillar. *a*, eggs, greatly enlarged ; *b*, *c*, caterpillars nearly full grown, and *d*, young caterpillars — natural size.

same color along the hinder margin. The hind-wings of the male are brownish, of the female dusky brown; the body is light brown, the thorax of a darker shade. With wings expanded they measure an inch and a quarter across."

Eggs.—The eggs are similar to those of the Yellow-necked Apple Caterpillar, being laid on the under side of a leaf, and are shown in figure 7, a. Eggs are laid from late June or early July until September 1st. But one brood occurs in a season.

REMEDIES.

As the work of these caterpillars is very quickly noticed and as they habitually feed together in colonies, it is an easy matter to hand pick and destroy them, or swab them off the limbs with a rag or waste saturated with kerosene. When a colony is noticed at the tip of a limb it may be cut off and burned, though this is rarely necessary. If this and other caterpillars are common upon the terminals it will be well to spray the trees about August 1st with arsenate of lead, three to five pounds per barrel. To be most effective this should be applied while the caterpillars are still small. (See page 225 concerning spraying.)

THE HICKORY TIGER MOTH.*

Though usually common upon hickory, walnut and butternut, for the past few seasons this caterpillar has been numerous in apple orchards. It also often attacks elm, ash, and linden, and willow. Clusters of partly grown caterpillars were found feeding upon the under sides of the leaves early in August.

Larvae.—The caterpillars become full grown during the latter half of September, when they are about 1½ inches long. The young caterpillars resemble the grown ones in coloration and are striking insects with their tufts of white and black hairs. The caterpillars are white with a row of eight black tufts along the back, two black, pencil-like tufts on the fourth and tenth segments; four white tufts on the second and third, and two on the eleventh and twelfth. The head, forelegs, and the surface of the body are covered with minute black tubercles and there is a transverse black line between each segment. (See figure 8.)

* *Halisidota caryae* Harris.

Fig. 8. Hickory Tiger Moth. *a*, larvæ, back and side views; *b*, moth enlarged; *c*, young caterpillars — natural size.

The caterpillar spins an oval grayish cocoon under stones or rubbish, in the crevices of a wall or bark, and transforms to the pupa, in which stage the winter is passed.

Moth.—(Figure 8, b.) The moths emerge about the middle of June (June 16, 1898; 21, 1900). The wings of the female expand from 1½ to 2 inches, the fore-wings being light brown, spotted with silvery white markings, and with the veins darker brown. The thorax is light brown, and the abdomen darker brown. The male is smaller and has the antennæ more feathered. The eggs are doubtless laid on the foliage about July 1st, but do not seem to have been observed.

REMEDIES.

Spraying with paris green or arsenate of lead about the 1st of August, as advised for the above caterpillars, will usually control this species equally well.

THE RUSTY TUSSOCK MOTH.*

One of our most common orchard caterpillars is that of the Rusty Tussock Moth, which is also, throughout most of the state, the most common of the three tussock moths to be described.

Eggs.—Very often the eggs of this insect are first noticed, as they are readily seen, upon the dead leaves attached to the tree during the winter, and are often sent to us mistaken for brown-tail moth eggs, which occur only in August. From 200 to 300 eggs are laid together on a leaf, as shown in figure 9. The eggs are bare with no covering as in the next species.

Larva.—The eggs hatch irregularly, some hatching about May 1st and others in the same mass not hatching until possibly a month later. Upon hatching the young larva feeds for a short time on the old egg shells before attacking the foliage. The caterpillars require about 35 days for their development, molting four times during growth. The full grown caterpillar resembles the two species next described, having the pencil or brush of black hairs projecting like a horn on either side of the head, and a similar median tuft near the tip of the abdomen, and with the four white tussocks of hairs on the middle of the first four abdominal segments. The present species, however, is much darker

*_Notolophus antiqua_ Linn.

than the others, being quite blackish in color, the head of the caterpillar is black, the retractile tubercles on the middle of the tenth and eleventh segments are orange, and projecting from each side of the second abdominal segment is a tuft or pencil of black hairs, often with a slighter and shorter pencil in front, which is wanting on the other two species. (See figure 10, b.)

The full grown caterpillar spins a loose cocoon upon a leaf or branch and transforms to the pupa during the first or second

Fig. 9. Eggs of Rusty Tussock Moth. (*Notolophus antiqua* Linn.)

week in June; 12 to 15 days later, or about June 20, the moths emerge.

Moth.—The female moth is wingless and looks very little like the male, being of a grayish color, looking more like a fat spider. She crawls out upon the cocoon where next day she lays her eggs and soon dies. The male is a rust-brown color with wings expanding slightly over an inch. The fore-wings are crossed by two darker bands and have a conspicuous white spot near the anal angle.

The eggs laid by these moths hatch early in July (July 5, 1905) and the caterpillars from them become mature in late summer. From them develop moths which lay eggs that remain on the trees over winter, thus making two complete broods each year.

As far as observed this species does not occur in such large numbers or do so serious damage as the White-marked Tussock

Moth, though it is much the more common species in all but extreme southern New Hampshire. This species is an importation from Europe and feeds upon practically all of our common fruit trees and many of the more common shade and forest trees, being possibly most common on apple and plum.

THE WHITE-MARKED TUSSOCK MOTH.*

Though common throughout the state, this species is only abundant in the southernmost towns, where it is often a serious pest of shade trees, as it is in Massachusetts and further south.

Eggs.—The eggs are laid in a mass upon the old cocoon upon the trunk or main limbs of the tree. This species covers its eggs with a white, frothy mass, so that the individual eggs are not visible.

Larvae.—Eggs commenced hatching May 7, 1905, and some of this mass were still hatching June 14, when some of the caterpillars first hatched were ready to pupate.

The general appearance of the caterpillar is like that of the preceding species, but the head is red, along each side of the black stripe which runs down the middle of the back is a distinct yellow stripe, and it lacks the black pencils on the sides of the second abdominal segment. Possibly the caterpillar is also slightly larger. The hairs from the bodies of these caterpillars are poisonous, like those of the brown-tail moth caterpillars, though not so badly, and often, when abundant, cause disagreeable irritation to a sensitive skin. The larvæ spin thin cocoons and pupate about the middle of June, the moths emerging late in June and first week of July. (June 29 to July 6, 1905.)

Moth.—The female moth is wingless and resembles that of the preceding species. The male is of a dull ash-gray color with several wavy dark gray lines crossing the forewings.

The life history practically duplicates that of the last species, two broods probably occurring in a season.

This species is most common on fruit and shade trees, but is known to attack practically all deciduous trees, and, according to Prof. Fernald, fir, spruce, larch and cypress.

* *Hemerocampa leucostigma* S. and A.

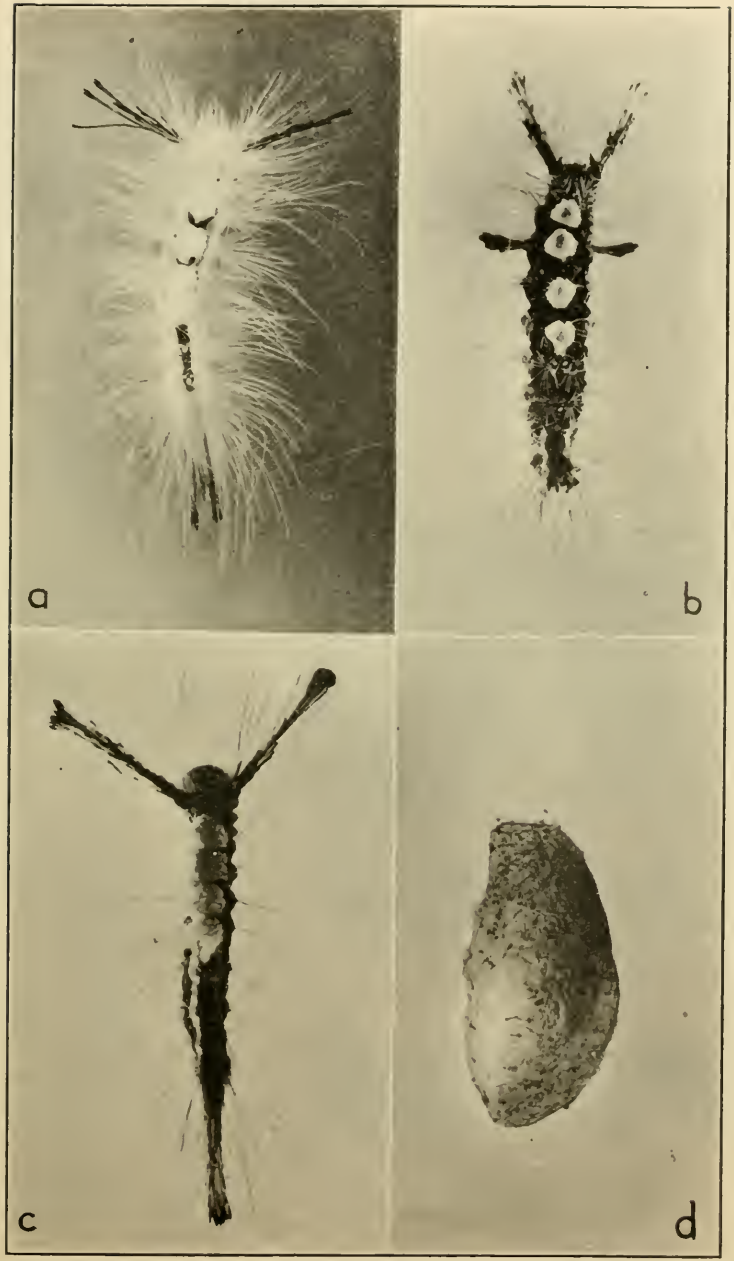

Fig. 10. The Tussock moth caterpillars. *a*, the willow tussock moth caterpillar, *Hemerocampa definita* Pack.; *b*, the rusty tussock moth caterpillar (*Notolophus antiqua* Linn.); *c*, the white-marked tussock moth caterpillar (*Hemerocampa leucostigma* S. & A.); *d*, cocoon of *N. antiqua*. All slightly enlarged.

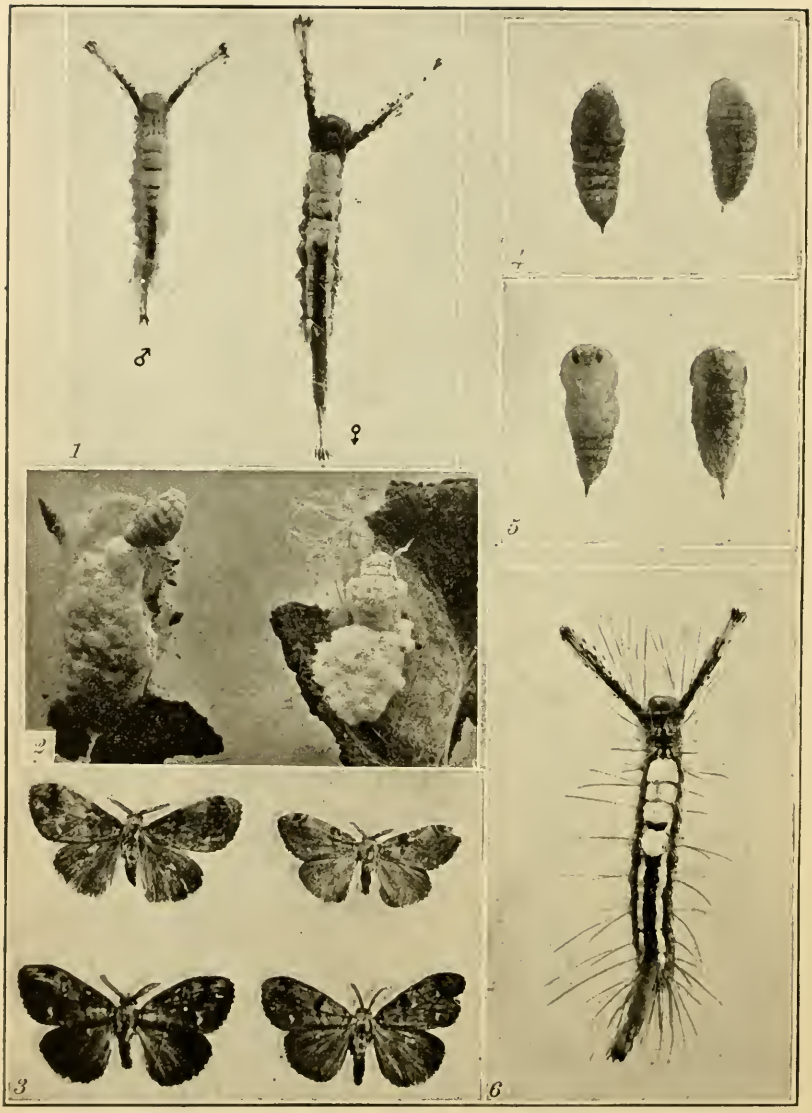

Fig. 11. The White-marked Tussock Moth :— 1, full grown male and female larvae ; 2, adult wingless females depositing eggs on cocoons ; 3, males ; 4, female pupae, from below and above ; 5, male pupae, from below and above ; 6, full grown larva.

REMEDIES FOR TUSSOCK MOTHS.

Evidently all of the Tussock Moths will respond to the same means of control on account of the similarity in life history.

In the winter the eggs may be easily removed and destroyed while pruning the trees. The treatment of these pests closely resembles that for the Gypsy Moth, to which they are nearly related. Where trees have been cleaned of eggs and neighboring trees are badly infested, which will usually occur only with the White-marked Tussock Moth in New Hampshire, they may be protected by banding with bodlime, tanglefoot, printers' ink on paper, or any similar sticky substance over which the caterpillars cannot crawl in ascending the tree, and which will not injure the tree.

Where apple orchards have been sprayed with an arsenical, such as Paris green or arsenate of lead late in May, in the usual manner for the codling moth and diseases, there will be little trouble with the first brood, and probably but few of the second. Should the second brood appear numerous, spraying about August 1st, as for the other apple caterpillars described, will destroy them.

SPRAYING FOR APPLE CATERPILLARS.

It will be noticed that most of the common apple caterpillars above described are injurious late in the summer and that spraying about August 1st is advised for their control. Inasmuch as the young caterpillars of the brown-tail moth, now so prevalent over southern New Hampshire, may also be controlled by spraying at this time, it would seem that a single thorough spraying might well become a customary orchard practice, the same as should the two sprayings in May and June for the codling moth, diseases, and spring caterpillars.

Insecticides.—Of the insecticides use Paris green or arsenate of lead. Paris green should be used at the rate of one pound to 100 gallons of water, to which should be added a pound or two of freshly slaked stone lime. In mixing stir up the Paris green with a little water so as to form a paste before adding to the barrel. Arsenate of lead is slightly more expensive, but the greatest cost of spraying is the labor, and it has decided advantages. It

adheres better than Paris green, not being so easily washed off by rains, and will not burn tender foliage even when used very strong. It is used at the rate of three to five pounds to a 50-gallon barrel of water.

Sprayers.—For spraying orchard trees the barrel sprayer is the most practical and can also be used for spraying potatoes and other garden crops. It is time wasted to try and spray large trees with a small bucket, knapsack, or compressed air pump, intended for garden work. The barrel sprayer should be as much a part of the equipment of every orchard owner as is his

Fig. 12. A good type of wagon and tower for the small orchard.

plow for corn culture. For orchard work a convenient outfit is shown in figure 12, consisting of a one-horse wagon upon which a rough platform has been erected, firmly bolted to the box, and thus placing the man who sprays three or four feet above the bed. The barrel is in front with the driver who pumps. Such an outfit can be readily built on any wagon at slight expense and is easily removed. With it orchard trees can be much more quickly and thoroughly covered, thus greatly reducing the cost of spraying, in which labor is the largest item of expense. Many good

types of barrel pumps are now on the market and can be obtained through seedsmen, agricultural warehouses or direct from the manufacturers, for whose addresses see the agricultural papers or Bulletin 131 of this station. Buy a pump with as little of its working parts above the head as possible; with cylinder and valves of brass, and other parts of malleable or galvanized iron—castings are always breaking; with a good mechanical agi-

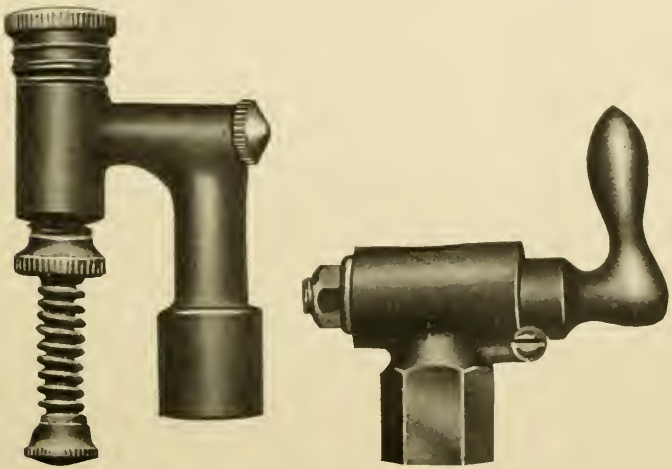

Fig. 13. The Vermorel nozzle. The Bordeaux nozzle.

tator—not a return jet—which can be operated by itself without pumping at the same time. The ease with which a pump may be removed from the barrel, and with which the working parts, such as the valves and cylinder, are reached and removed for cleaning or adjustment, are important points. A good barrel pump should have a large air chamber so that a steady pressure of 75 pounds can be maintained with four nozzles. A good pump with hose and 10-foot bamboo extension rod, and nozzles, can be purchased for from $15 to $30.

A good nozzle is of next importance, and many beginners fail to secure good results in spraying through buying a cheap nozzle from some local dealer. The two types of nozzles shown in figure 13 are the best for orchard work. Many similar types slightly varying from these are on the market, each having its advocates, and all doing fairly satisfactory work. The Vermorel

type is possibly more used for orchard work and the Bordeaux for garden and row spraying. Where orchard trees are to be sprayed a double or triple nozzle is usually used, thus increasing the volume of spray and covering the tree more quickly.

In all foliage spraying the finest spray should be used, as it covers the foliage most evenly with the least amount of material. A fine spray will not carry over four or five feet at ordinary pressures, unless aided by the wind, and those nozzles advertised to spray ten feet or more are undesirable. In spraying, hold the nozzle away from the tree so that the spray may settle over it like a fog, except where adverse wind makes this impossible, and stop spraying when the foliage is wet and before it drips much. A bamboo extension rod with cut-off cock at the base enables one to reach the tops of large trees and to work much faster. Other points regarding spraying will be found in bulletin 131 of this station.

SUMMARY:—The fall web-worms, yellow-necked apple caterpillars, red-humped apple caterpillars, tussock moth caterpillars and hickory tiger moth caterpillars injure apple foliage in late summer. They may be controlled by spraying with an arsenical insecticide about August first. As it is also desirable to spray for the brown-tail moth at this time, an early August spraying may well be made a regular orchard practice, for which directions are given.

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